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Extrasolar planet searches at the TUG: Test observations and capabilities ☆

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HIGHLIGHTS

- We started a extrasolar planet search survey at Turkish National Observatory.
- I2-cell was successfully installed to the Coude Echelle Spectrograph at RTT150.
- We achieved a precision about 10 m/s for CES on RTT150.
- A specific computer code was developed to determine radial velocity measurements.
- We continue to follow radial velocity variations of 50 selected G and K giants.

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ABSTRACT

A small group of collaborators was established at the end of 2007 with the objective of starting an extrasolar planet search at the TÜBİTAK National Observatory of Turkey. High resolution spectra of some radial velocity standards and planet-harbouring stars have since been obtained using an iodine (I_2) absorption cell placed in front of the entrance slit of the Coude Echelle Spectrograph (CES) in the 1.5-m Russian-Turkish Telescope (RTT150). To determine precise radial velocity measurements for these stars, a new computer code was developed by one of the collaborators (MY) using an IDL (Interactive Data Language) programing platform specific to the RTT150's CES + I_2-cell data. This paper summarises the technical setup, the new code, the test observation results and the precision achieved in the radial velocity measurements. The results from radial velocity standards and planet-harbouring stars show that a precision of approximately 10 m s^{-1} was achieved with the CES on the RTT150 during the three years of test observations. In addition, the instrumental profile (IP) characteristics of the CES on the RTT150 in this study were derived by modelling the observed B-star + I_2 spectra. The observed instrumental profiles were a typical Gaussian shape and exhibited small variations that depended on the position on the CCD and also varied between exposures, which affected the precision of the radial velocity measurements.

1. Introduction

The new observational techniques and instrumentation that have been introduced in the last two decades have led to the discovery of very low mass planetary companions around distant stars. These new techniques have different capabilities that are primarily directed at the detection of tiny wobbles of a star in terms of radial velocity or position due to gravitational attraction by an orbiting planet and/or photometric transits (eclipse effects) in conveniently lined-up planet-star systems. For details regarding various detection and data analysis techniques, refer to recent reviews by Doyle (2008) and Santos (2008). Since the first discovery of a planetary companion around a solar-like star in 1995 (Mayor and Queloz, 1995), more than 750 extrasolar planets have been discovered (see http://exoplanet.eu), and their numbers are continuing to increase. Most of these objects have been found with the so-called Doppler technique, which is based on precise radial velocity (RV) measurements.

One method utilised to obtain precise RV measurements involves the use of a gas absorption cell. A gas absorption cell can be added to existing spectrographs without extensive modifications and can greatly enhance the potential of the spectrographs,

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